Volume 3
1970
Pages L1–60, 1–802

Journal of Physics A

General Physics

EUROPHYSICS JOURNAL

THE INSTITUTE OF PHYSICS AND
THE PHYSICAL SOCIETY

LONDON AND BRISTOL

Copyright © 1970 by the Institute of Physics and The Physical Society and individual contributors. All rights reserved.

Under Part 1, Section 7 of the Copyright Act 1956 some libraries are permitted to make single copies of articles for individuals requiring them for the purpose of research or private study. The classes of library accorded this privilege and the conditions under which it is available are set out in the Act and in the associated Board of Trade regulations (Statutory Instruments, 1957, No. 868). Most libraries attached to higher educational establishments and research organizations, whether in the UK or elsewhere, qualify for this privilege provided that they were not established, and are not conducted, for profit. The Act, however, restricts the concession to material not exceeding one article in any one publication and requires that the individual making use of the service must pay at least the cost price of producing the copy.

Except for single copies covered by the concession relating to research and private study no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without permission of the copyright owners.

Published by The Institute of Physics and The Physical Society, 47 Belgrave Square, London SW1, England, in association with the American Institute of Physics.

Journal of Physics A: General Physics is published as a bi-monthly journal. Details are available on request.

Printed in Great Britain by J W Arrowsmith Ltd. Set in 11/12pt Imprint.

Editorial board 1970

Professor R G Chambers MA PH D *Honorary Editor and Chairman*
Professor L L Green MA PH D F INST P
E R Pike B SC PH D F IMA F INST P
Professor F A E Pirani MA PH D D SC
Professor E J Squires B SC PH D F INST P
M F Sykes MA D PHIL
J B Taylor B SC PH D F INST P FRS
Professor J G Valatin D ING D SC
Professor A W Wolfendale PH D D SC F INST P

From July 1970

Professor D Sette D ING

Assistant editor

Up to March 1970

Mrs M A Wright B SC

From March 1970

Mr P E Lafferty M SC PCE GRAD INST P

Senior editorial assistant

From March 1970

Mr R L Ellsworth B SC GRAD INST P

Contents

NO 1 JANUARY 1970

Letters to the editor

L1 *C S Sharma* · Sequences of functionals for the evaluation of eigenvalues of the Lippmann–Schwinger kernel

L2 *N McDonald* · Comments on properties of projected spectra

Papers

1 *N Anderson, A M Arthurs and P D Robinson* · Upper and lower bounds on scattering lengths

8 *V N Fomenko* · Projection in the occupation-number space and the canonical transformation

21 *S G Whittington and J P Valleau* · Figure eights on the square lattice: enumeration and Monte Carlo estimation

28 *S G Whittington* · The excluded volume effect in polymers

33 *J S Dowker* · On the geometry of chiral dynamics: I

45 *J S Dowker* · On the geometry of chiral dynamics: II

59 *J S Dowker* · Non-local Yang–Mills theory

70 *A Lakshmana Rao, J Rama Rao and K Parthasaradhi* · On the observed variation of nuclear temperature with bombarding energy in the ^{55}Mn(α, n) ^{58}Co reaction

73 *W M Currie, L G Earwaker, J Martin and A K Sen Gupta* · Lifetimes in some even nuclei in the s–d shell

79 *K O Thielheim and R Beiersdorf* · Monte Carlo studies on the electromagnetic component of extensive air showers

89 *D Leiter* · Interaction theory and Lagrangian electrodynamics

92 *B K Sawhney* · Self and mutual interaction of electromagnetic waves in a magnetoplasma considering the dependence of electron density on electron temperature

101 *C C Davis and T A King* · Correction methods for photon pile-up in lifetime determination by single photon counting

110 **Book reviews**

NO 2 MARCH 1970

Letters to the editor

L5 *P Ray Chaudhuri* · Neutrinos and arrow of time in cosmology

Papers

113 *P T Landsberg and K A Johns* · Ergodicity and the Lorentz transformation of time-based probabilities

121 *K A Johns and P T Landsberg* · Maximum entropy arguments in relativistic statistical mechanics

128 *R Davidson and J Rae* · On the nature of irreversibility in soluble classical systems

136 *J B Griffiths and R A Newing* · The two-component neutrino field in general relativity

149 *B O J Tupper and G W Phillips* · Kilmister's alternative field equations in general relativity: static spherically symmetric solutions

166 *A Srinivas Rao* · Lorentz pole analysis of the reaction $\pi^+ n \to \omega p$

170 *V P Seth, M C Sharma and B K Agarwal* · Unitary symmetry and superconvergence relations

175 *M C Sharma, V P Seth and B K Agarwal* · Superconvergence sum rules for backward meson–baryon scatterings

179 *M El-Nadi and M A Sharaf* · Multi-nucleon transfer reactions

189 *D O Riska and S Stenholm* · On the quantum theory of a laser with inhomogeneous broadening

201 *E Jakeman* · Theory of optical spectroscopy by digital autocorrelation of photon-counting fluctuations

216 *P J Bourke, J Butterworth, L E Drain, P A Egelstaff, A J Hughes, P Hutchinson, D A Jackson, E Jakeman, B Moss, J O'Shaughnessy, E R Pike and P Schofield* · A study of the spatial structure of turbulent flow by intensity-fluctuation spectroscopy

229 **Book reviews**

NO 3 MAY 1970

Letters to the editor

L9 *D L Misell* · Plural electron scattering and the inclusion of phase factors

L11 *D J Gates* · Correlation functions for classical systems in the van der Waals limit

L16 *D C Leslie* · Simplification of the direct interaction equations for turbulent shear flow

L19 *G Chanmugam* · The equation of state of matter at ultra-high densities

L21 *M W Alcock and B E Keen* · Experimental observation of the drift-dissipative instability in afterglow plasmas

L24 *F Hynne* · Screening of the photon propagator in many-body optics

L29 *W Van Dael and H Cauwenbergh* · Experimental evidence of a minimum in the thermal conductivity against composition curve for the He–HD mixture

Papers

233 *R Loudon* · The propagation of electromagnetic energy through an absorbing dielectric

246 *T P Khan* · Radiation of a Hertzian oscillator moving with superluminal velocity through a dielectric medium
251 *J R Ellis* · Force and couple exerted on a moving electromagnetic dipole
263 *A K Raychaudhuri and U K De* · Charged-dust distributions in general relativity
269 *J B Griffiths and R A Newing* · Tetrad equations for the two-component neutrino field in general relativity
274 *M C Jain and Y R Waghmare* · Nuclear energy gap calculations using realistic and delta-function forces
280 *A B Saxena, B K Agarwal and C P Singh* · K* (892) production in the rescattering model
284 *E W Kellermann and L Towers* · The electromagnetic component of large air showers
296 *Abou El Magd A Mohamed and N K Nayyar* · Electrohydrodynamic stability of a liquid jet
304 *P C Stangeby and J E Allen* · Plasma boundary as a Mach surface
309 *S C Saxena and V K Saxena* · Thermal conductivity data for hydrogen and deuterium in the range 100–1100 °C

321 **Book reviews**

327 **Book notices**

NO 4 JULY 1970

Letters to the editor

L33 *P Bandyopadhyay and P Ray Chaudhuri* · Some remarks on the possible origin of superheavy nuclei in primary cosmic rays

Papers

331 *W Maass* · On the sign of successive time derivatives of Boltzmann's *H* function
335 *J G Powles and B Carazza* · A 'non-classical' information theory of spectral line shape
342 *G J Papadopoulos and A V Jones* · A note on ring integrals and the Fermi function
346 *E R Pike and S Swain* · An expansion of the master equation with applications to coupled atom–radiation systems
357 *P M Mathews* · Covariant theory of the quantized electromagnetic field with only physical photons
368 *L M Stephenson* · Time measurement using a realizable atomic clock in a moving frame of reference
378 *M L Chaudhury* · Non-local barrier and anisotropy of alpha emissions from oriented ^{237}Np nuclei
390 *K W C Stewart and B Castel* · An intermediate coupling model for Br isotopes

400 *R Y Prasad and R N Singh* · Temporal and spatial covariation of high-latitude geophysical phenomena
404 *T N Bhatnagar and S R Sharma* · Propagation of waves along the magnetic field in a two-component warm plasma
413 *J G Andrews and R H Varey* · The sheath at an electrode close to plasma potential
421 *G J Pert* · A model of an ionizing current sheet
427 *G M Bell and D A Lavis* · Two-dimensional bonded lattice fluids: I—Interstitial model

442 Book reviews

450 Corrigendum

NO 5 SEPTEMBER 1970

Letters to the editor

L37 *M Bertolotti, B Crosignani and P Di Porto* · On the statistics of Gaussian light scattered by a Gaussian medium
L39 *J G Andrews and P C Stangeby* · Generalization of the sheath criterion in an anisotropic plasma
L40 *C N Lashmore-Davies* · A possible mechanism for instability in a perpendicular collisionless shock wave
L45 *E Jakeman, C J Oliver and E R Pike* · The effects of spatial coherence on intensity fluctuation distributions of Gaussian light

Papers

451 *J S Dowker* · When is the 'sum over classical paths' exact?
462 *A F Jones and D L Misell* · The problem of error in deconvolution
473 *R V Kamat* · On Wheeler–Feynman absorber theory of radiation
481 *L C Robinson and G Szekeres* · Motion of charged particles in a helically perturbed magnetic field
493 *P Rastall* · The metric of moving bodies
501 *A Banerjee* · Null electromagnetic fields in general relativity
505 *M R Wallace* · Perturbation of relativistic bootstraps
520 *V N Fomenko* · On the structure of the paired states
524 *Y P Varshni and S Bose* · On the Krutov model for deformed even–even nuclei
533 *M A K Lodhi* · Independent-particle-model energy levels
536 *D O Riska and S Stenholm* · The effects of detuning on the quantum theory of an inhomogeneously broadened laser
547 *Sunita Jayaram and V K Tripathi* · Mixing of two microwaves and emission of low-frequency waves from a plasma slab
559 *A T Jackson* and *J R M Coulter* · Ionization–diffusion waves in the helium positive column
563 *D E G Williams and K Goto* · The chemical potential of an electron gas

568 *G M Bell and D A Lavis* · Two-dimensional bonded lattice fluids: II—Orientable molecule model

582 **Book reviews**

584 **Book notices**

NO 6 NOVEMBER 1970

Letters to the editor

L49 *L M Stephenson* · Possible implications of the 3K background radiation

L50 *S Codreanu* · On the equations governing the second-order correlation functions for the velocity and the magnetic field of isotropic hydromagnetic turbulence in an incompressible fluid

L52 *E Jakeman, C J Oliver, E R Pike, M Lax and M Zwanziger* · The intensity fluctuation distribution of laser light

L55 *E Jakeman, E R Pike and S Swain* · Statistical accuracy in the digital autocorrelation of photon counting fluctuations

Papers

587 *N Anderson, A M Arthurs and P D Robinson* · Complementary bounds on phase shifts

595 *L A Dissado* · Absorption and refraction of radiation by liquids: I—Refraction by pure liquids

608 *L A Dissado* · Absorption and refraction of radiation by liquids: II—Solvent effects on the absorption intensity

618 *N D Sen Gupta* · On the time-dependent perturbation theory

625 *Suraiya Perveen* · Renormalization problem of the Yang–Mills theory with non-zero mass: The spectral approach

630 *D A F Omojola* · Neutron–alpha scattering

653 *A Barnes* · On gravitational collapse against a cosmological background

662 *A M Bakich, C B A McCusker and M M Winn* · High transverse momenta observed in air shower cores

689 *R B Coats, S Ozaki, R O Stenerson, H E Bergeson, J W Keuffel, M O Larson, G H Lowe, H L Osborne and J H Parker* · Lateral distribution of muon pairs in underground cosmic-ray showers

697 *C Adcock, R B Coats, A W Wolfendale and J Wdowczyk* · The mean transverse momentum of secondaries from cosmic-ray interactions in the region of 2×10^5 GeV

708 *R K Bullough* · Many-body optics: III—The optical extinction theorem and $\epsilon_l(\boldsymbol{k}, \omega)$

726 *R K Bullough* · Many-body optics: IV—The total transverse response and $\epsilon_t(\boldsymbol{k}, \omega)$

751 *R K Bullough* · Many-body optics: V—Virtual mode theory, and phenomenological binding energies in the complex-dielectric-constant approximation

774 *T G Cowling* · Approximate theories of thermal diffusion

783 **Book reviews**

785 **Book notices**

786 **Corrigendum**

787 **Subject index, Vol 3**

796 **Author index (with titles), Vol 3**

802 **Book review index, Vol 3**

Journal of Physics A: General Physics
1970, Volume 3

Subject index

Introduction

The entries in this index refer to the papers and Letters by their page number. The entries are grouped under headings. If a heading for a particular subject does not appear, the subject may be in the form of a crossreference to another heading, perhaps of a more general nature. Many of the headings are subdivided by the use of subheadings, which are indented (i.e. printed slightly to the right) and commence with a small letter.

The information contained in the subject index is illustrated by the following example:

main heading — *crossreferences to other headings*

Plasma, *see also Electric discharges; Electrons; Ions*

page numbers

ion motion and boundary as closed Mach surface 304–8

entry

subheading

confinement

sheath boundary, a Mach surface L39–40

entry

Associated with the main heading 'Confinement of plasma' is a 'see' crossreference as follows:

main heading — *crossreference to other heading*

Confinement of plasma, *see Plasma/confinement*

This means that for papers on 'Confinement of plasma' the reader should consult the subheading 'confinement' of 'Plasma' as displayed above.

Arrangement of headings and subheadings

The headings and crossreferences are arranged throughout the index in alphabetical order according to the 'word by word' system. The subheadings are themselves arranged in alphabetical order under their respective headings.

Arrangement of entries under headings

Entries are arranged in four distinct groups as follows:

First group: arabic numerals

Second group: English alphabet (A–Z), roman numerals, Greek alphabet (excluding elementary particles)

Third group: elementary particle symbols, that is, the Greek and English alphabet, e.g. μ (muon), p (proton)

Fourth group: chemical formulae (including entries beginning with nuclei, e.g. ^{57}Fe).

Nuclei

Papers on nuclei whose mass number (or mass number range) is given are listed under a set of headings which begin 'Nuclei . . . ', e.g. Nuclei with $6 \leqslant A \leqslant 19$ where A is the mass number.

Absorption
  electromagnetic waves in liquids, solvent effects on intensity 608–17
Aerodynamics, *see Flow; Jets; Turbulence*
Afterglow, *see Electric discharges*
Alfvén waves, *see Magnetohydrodynamics; Plasma and subheadings*
Algol, *see Digital computer programs*
Alpha particle model, *see Nucleus/models*
Alpha particles, *see also Nuclear reactions and scattering*
  anisotropy and non-local barrier from oriented ^{237}Np nuclei 378–89
  nα, elastic scattering, new formulation using most general form of nuclear interaction 630–52
  effects, *see Nuclear reactions and scattering*
Angular distribution, *see Electrons; Neutrons and antineutrons; Protons and antiprotons*
Angular momentum theory, *see Quantum theory*
Antineutrinos, *see Neutrinos and antineutrinos*
Antineutrons, *see Neutrons and antineutrons*
Antinucleons, *see Nucleons and antinucleons*
Antiparticles, *see under corresponding particle*
Antiprotons, *see Protons and antiprotons*
Astronomical spectra, *see Cosmic rays*
Atomic spectra, *see Spectra*
Atoms, *see also Nucleus*
  Hertzian oscillator, radiation when moving superluminal velocity through dielectric 246–50
  radiation resonant interactions, application of master equation expansion 346–56
Attenuation, *see Absorption*
Auger showers, *see Cosmic rays*

Baryons, *see also Hyperons; Nucleons and antinucleons*
  meson–baryon, elastic, unitary symmetry and superconvergence relations 170–4
Bending of light, *see Gravitation; Light*
Bethe–Salpeter equation, *see Field theory/quantum*
Bethe–Uhlenbeck equations, *see Statistical mechanics*
Boltzmann equation, *see Transport processes*
Bootstrap theory, *see Field theory/quantum*
Breakdown, electric, *see Electric discharges*
Bursts, cosmic rays, *see Cosmic rays*

CPT (charge, parity, time) conservation, *see Kaons*
Calculus, *see Integrals; Mathematics*
Capture cross-sections, *see Nuclear reactions and scattering*
Čerenkov radiation
  Hertzian oscillator with superluminal velocity through dielectric medium 246–50
Clebsch–Gordan coefficients, *see Field theory, quantum; Nucleus; Quantum theory*
Clock paradox, *see Relativity*
Coherence, *see Lasers; Light/coherence*
Complementarity, *see Quantum theory*
Computer programs, digital, *see Digital computer programs*
Conductivity, thermal, *see Thermal conductivity*
Confinement of plasma, *see Plasma/confinement*
Continuous creation hypothesis, *see Cosmology*
Correspondence principle, *see Quantum theory*
Cosmic rays, *see also Pulsars*
  air shower cores, high transverse momenta observation 662–88
  EAS e.m. component, Monte Carlo studies 79–88
  electromagnetic component of large air showers 284–95
  lateral distribution of muon pairs in underground showers 689–96
  microwave background radiation, explanation of anomalies L49–50
  muon secondaries from interactions in 2×10^5 GeV region, mean transverse momentum 697–707
  primary origin of superheavy nuclei $Z \geqslant 110$ from pulsars L33–6
  secondaries from interactions in 2×10^5 GeV region, mean transverse momentum 697–707
Cosmology
  arrow of time and neutrinos L5–8
  gravitational collapse against cosmological background 653–61
  microwave background radiation, explanation of anomalies L49–50
Couette flow, *see Flow; Hydrodynamics*

Dark space, *see Electric discharges*
Deuterium
thermal conductivity measurement 100–1100 °C 309–20
Deuteron interactions, *see Nuclear reactions and scattering*
Dielectric properties of substances
absorption intensities in terms of vapour phase solute transition dipole moment and solvent dielectric properties 608–17
electromagnetic energy propagation through absorbing classical dielectric 233–45
optical extinction theorem and $\epsilon_t(k, \omega)$ 708–25
optical response, transverse, and $\epsilon_t(k, \omega)$ 726–50
pure liquid, dielectric constant expressions from quantum electrodynamics 595–607
virtual mode theory and phenomenological binding energies in complex dielectric constant approximation 751–73
Dielectric relaxation, *see Dielectric properties of substances*
Diffusion columns, *see Thermal diffusion in gases*
Diffusion in gases, thermal, *see Thermal diffusion in gases*
Digital computer programs
algol programs for nα scattering calculations 630–52
Discharges, electric, *see Electric discharges*
Dispersion relations, *see also Field theory, quantum; S-matrix theory*
Dynamics
path integral formulation, spherical top calc. generalized to free particle 451–61

Eightfold way, *see Field theory, quantum*
Electric discharges, *see also Plasma*
positive column ionization-diffusion waves 559–62
Electrodynamics, *see also Quantum electrodynamics*
force and couple exerted on moving electromagnetic dipole 251–62
Lagrangian, and interaction theory 89–91
particle motion in helically perturbed magnetic field, soln of equations 481–92
Wheeler–Feynman formalism of absorber theory of radiation 473–80
Electromagnetic radiation, *see Light; Photons; Radiation*
Electromagnetic wave absorption, *see Absorption*
Electromagnetic wave refraction, *see Refraction of electromagnetic waves*
Electromagnetism, *see also Electrodynamics; Quantum electrodynamics*
Einstein–Maxwell equations class of solutions corresponding to stationary null electromagnetic fields 501–4
waves in dielectric, absorbing classical, energy transport velocity 233–45
Electron affinity; *see Atoms; Ions*
Electrons, *see also Plasma*
angular distributions of plurally scattered electrons and phase factor inclusion L9–11
chemical potential changes due to changes in volume of electron gas 563–7
radiation, *see Čerenkov radiation; Electrodynamics*
Elementary particles, *see Baryons; Field theory, quantum, Hadrons; Nucleons and antinucleons; Nucleus; Quantum theory and individual particles e.g. Electrons; Mesons*
Emission spectra, *see Spectra*
Energy levels, *see Atoms; Nucleus/energy levels; Spectra*
Equations of state, *see also Thermodynamics*
at ultra-high densities, Zeldovich's results with many-body forces L19–21
Ergodic theorem, *see Statistical mechanics*
Extra-terrestrial radiation, *see Cosmic rays*

Fermi gas, *see Quantum fluids*
Fermion systems, *see Quantum fluids*
Fermions, *see Quantum fluids; Statistical mechanics/quantum*
Field theory, classical, *see Electromagnetism; Gravitation; Relativity*
Field theory, quantum, *see also Quantum theory*
electromagnetic with only physical photons, covariant theory and quantization 357–67
Yang–Mills non-local theory 59–69
Yang–Mills theory with non-zero mass, spectral approach to renormalization problem 625–9
electromagnetic field, *see Quantum electrodynamics*
meson field, *see Mesons; Nuclear forces*

Fields, electromagnetic, *see Electromagnetism*
Flow, *see also Hydrodynamics; Jets; Turbulence*
turbulent shear, direct interaction equations, simplification of L16–8
water, turbulent, spatial velocity distribution obs. using intensity-fluctuation spectroscopy 216–28
Fluctuations
laser light, intensity fluctuation distribution L52–5
Fluid flow, *see Flow*
Fluid mechanics, *see Hydrodynamics*
Fluids
bonded lattice fluids, 2D, interstitial model 427–41
incompressible, isotropic hydromagnetic turbulence correlation functions of velocity and magnetic field L50–2
optical extinction theorem and $\epsilon_t(\boldsymbol{k}, \omega)$ 708–25
optical response, transverse, and $\epsilon_t(\boldsymbol{k}, \omega)$ 726–50
turbulent shear flow, direct interaction equations, simplification of L16–8
two dimensional bonded lattice fluid, orientable molecule model 568–81
virtual mode theory and phenomenological binding energies in complex dielectric constant approximation 751–73
Force, *see Dynamics*
Franck–Condon factors, *see Spectra*
Furry theorem, *see Quantum electrodynamics*

g-factor, *see Nucleus; Spectra*
Gas flow, *see Flow*
General relativity, *see Relativity*
Geophysics
temporal and spatial covariation of high-latitude phenomena 400–3
Gravitation, *see also Relativity*
collapse against cosmological background 653–61
Gravitational collapse, *see Gravitation*
Gravitational red shift, *see Relativity*
Group theory
chiral dynamic geometry 33–44
chiral dynamic geometry 45–58

Hadrons
bootstrapping bound state scalar and vector mesons, applic. of linear perturbation procedures 505–19
chiral dynamic geometry 33–44
chiral dynamic geometry 45–58
Hard sphere gases, *see Quantum fluids; Statistical mechanics*
Harmonic generation, optical, *see Lasers; Optics*
Harmonic oscillators, *see Quantum theory*
Heat conduction, *see Thermal conductivity*
Heisenberg model, *see Statistical mechanics*
Helicity, *see Field theory, quantum*
Helium, *see also Quantum fluids; Statistical mechanics/quantum*
gas, positive column ionization–diffusion waves 559–62
He–HD mixture, thermal conductivity against composition L29–31
Hellmann–Feymann theorem, *see Quantum theory*
Hollow cathode, *see Electric discharges*
Hydrodynamics, *see also Flow; Jets; Magnetohydrodynamics*
electrohydrodynamic stability of liquid jet 296–303
Hydrogen, *see also Deuterium*
thermal conductivity measurement 100–1100 °C 309–20
Hydrogen compounds, *see also Water*
HD–He mixture, thermal conductivity against composition L29–31
Hydromagnetics, *see Magnetohydrodynamics*
Hyperons, *see also Mesons*
$\bar{K}\Lambda \rightarrow \bar{K}\Sigma$, superconvergence sum rules 175–8
Hypochroism, *see Absorption; Polymers*

Independent particle model, *see Nucleus*
Information theory
non-classical for spectral line shape 335–41
Insulating materials, electrical, *see Dielectric properties of substances*
Insulating materials, thermal, *see Thermal conductivity*
Integrals
convolution, including error 462–72
path integral formulation, spherical top calc. generalized to free particle 451–61
Ionized gases, *see Ions; Plasma*
Ions, *see also Atoms; Plasma*
velocity in plasma, sheath-boundary as Mach surface 304–8
He positive column ionization–diffusion waves 559–62
Irasers, *see Lasers*

Jets
liquid, electrohydrodynamic stability 296–303
Jets, cosmic ray, *see Cosmic rays*

Kaons
$K^-p \rightarrow K^{*-}p$, $K^*(892)$ production in rescattering model 280–3
$K\Lambda \rightarrow K\Sigma$, superconvergence sum rules 175–8
$KN \rightarrow KN$, superconvergence sum rules 175–8
$K^*(892)$ in rescattering model, $K^-p \rightarrow K^{*-}p$ 280–3
Knudsen number, *see Flow; Hydrodynamics*

Langmuir probes, *see Electric discharges; Plasma*
Lasers, *see also Light/coherence*
beams, intensity fluctuation distribution L3
noise, photon-counting distributions over range of sample times and pumping levels L52–5
quantum theory, with inhomogeneous broadening 189–200
quantum theory of Scully and Lamb reformulated to include detuning 536–46
Lattice gas, *see Statistical mechanics*
Lattice theory and statistics
bonded lattice fluids, 2D, interstitial model 427–41
Lie groups, *see Field theory, quantum; Group theory*
Light, *see also Radiation*
Gaussian, intensity fluctuation distrib., spatial coherence effects L45–50
coherence, *see also Lasers*
spatial coherence, effects on intensity fluctuation distributions L45–50
quantum theory, *see Photons; Quantum electrodynamics; Quantum theory*
scattering
Gaussian light scattering by Gaussian medium, statistics, photon counting probability distribution L37–8
Linewidths, *see Spectral line breadth*
Liouville equation, *see Statistical mechanics*
Liquid drop model, *see Nucleus*
Liquid flow, *see Flow*
Lorentz transformation, *see Relativity*

Mach's principle, *see Relativity*
Magnetic bottles, *see Plasma/confinement*
Magnetic traps and wells, *see Plasma/confinement*
Magnetogasdynamics, *see Magnetohydrodynamics*
Magnetohydrodynamics
turbulence, isotropic hydromagnetic, correlation functions of velocity and magnetic field L50–2
Majorana forces, *see Nuclear forces*
Many body problems
optics, screening of photon propagator L24–9
Many-particle systems, *see Statistical analysis/quantum*
Masers, optical, *see Lasers*
Mass transfer, *see Transport processes*
Master equation, *see Transport processes*
Mathematics
figure eights on square lattice, enumeration and Monte Carlo estimation 21–7
Maxwell–Boltzmann equation, *see Statistical mechanics*
Maxwell equations, *see Electromagnetism*
Measurement errors
photon counting fluctuations, digital autocorrelation, statistical accuracy L55–9
Mechanics, *see Dynamics*
Mechanics of liquids, *see Hydrodynamics*
Mesons, *see also Cosmic rays; Hyperons; Kaons; Pions*
bootstrapping bound state scalar and vector mesons, applic. of linear perturbation procedures 505–19
meson–baryon, elastic scattering, unitary symmetry and superconvergence relations 170–4
$K^*(892)$ production in rescattering model, $K^-p \rightarrow K^{*-}p$ 280–3
Models, nuclear, *see Nucleus*

Navier–Stokes equations, *see Flow; Hydrodynamics*
Neutrinos and antineutrinos
arrow of time in cosmology L5–8
field in general relativity, tetrad equations for 269–73
two-component field, in general relativity 136–48
Neutrons and antineutrons, *see also Nuclear reactions and scattering; Nucleons and antinucleons*
$n\alpha$, elastic scattering, new formulation using most general form of nuclear interaction 630–52
$\pi^+n \rightarrow \omega_p$, high-energy behaviour, Lorentz pole analysis 166–9
Newtonian fluids, *see Fluids*

Nitrogen
thermal conductivity measurement 100–1100 °C 309–20
Noise
laser, photon-counting distributions over range of sample times and pumping levels L52–5
electrical, *see Cosmic rays*
Non-Newtonian fluids, *see Fluids*
Nuclear decay theory, *see Nucleus*
Nuclear energy level lifetimes, *see Nucleus/energy level transitions*
Nuclear excitation, *see Nucleus/energy levels*
Nuclear field theory, *see Field theory, quantum*
Nuclear forces, *see also Field theory, quantum*
Morse function type potential velocity and energy dependent, with spin-orbit splitting 533–5
^{16}O, neutron separation energies calc. with Morse function type potential 533–5
Nuclear interactions, *see Field theory, quantum; Nuclear reactions and scattering*
Nuclear isomerism, *see Nucleus/energy levels*
Nuclear matter, *see Nucleus*
Nuclear reactions and scattering
multi-nucleon transfer reactions, matrix element calculation method 179–88
phase shifts for scattering by short-range potentials, upper and lower bounds 587–94
^{13}C (d, ^{6}Li) ^{9}Be, four-nucleon transfer matrix element calculation 179–88
^{4}He, elastic scattering of neutrons, new formulation using most general form of nuclear interaction 630–52
^{55}Mn (α,n) ^{58}Co, nuclear temperature variation with bombarding energy obs. 70–2
mesons, *see Cosmic rays*
Nuclei $A \leqslant 5$
^{4}He, neutron scattering, new formulation using most general form of nuclear interaction 630–52
Nuclei $6 \leqslant A \leqslant 19$
^{16}O, neutron separation energies calculation with Morse function type potential 533–5
Nuclei $20 \leqslant A \leqslant 49$
^{38}Ar in s–d shell, lifetimes meas. by Doppler shift attenuation method 73–8
^{40}Ar in s–d shell, lifetimes meas. by Doppler shift attenuation method 73–8
^{40}Ca, neutron separation energies calc. with Morse function type potential 533–5
^{24}Mg in s–d shell, lifetime meas. by Doppler shift attenuation method 73–8
^{34}S in s–d shell, lifetime meas. by Doppler shift attenuation method 73–8
^{30}Si in s–d shell, lifetimes 73–8
Nuclei $50 \leqslant A \leqslant 89$
^{79,81}Br, intermediate coupling model for low-lying levels 390–9
^{55}Mn(α, n) ^{58}Co, nuclear temperature variation with bombarding energy obs. 70–2
Ni quasi-particle structure of ground state of pairing Hamiltonian 520–3
Nuclei $150 \leqslant A$
^{237}Np, oriented, alpha emission, non-local barrier and anisotropy 378–89
^{206}Pb quasi-particle structure of ground state of pairing Hamiltonian 520–3
Nucleons and antinucleons, *see also Neutrons and antineutrons*
$\bar{K}N \rightarrow \bar{K}N$, superconvergence sum rules 175–8
Nucleus, *see also Nuclear forces*
energy gap calculations using realistic and delta-function forces 274–9
Hartree–Fock state projection of angular momentum J^2 eigenstate energies L2–4
Krutov model for deformed even–even nuclei, rotational energy levels of ground state band 524–32
pairing model, quasi-particle structure of ground state 520–3
^{79,81}Br, intermediate coupling model for low-lying levels 390–9
energy level transitions
^{38}Ar in s–d shell, lifetime meas. by Doppler shift attenuation method 73–8
^{40}Ar in s–d shell, lifetimes meas. by Doppler Shift attenuation method 73–8
^{24}Mg in s–d shell, lifetime meas. by Doppler shift attenuation method 73–8
^{34}S in s–d shell lifetime meas. by Doppler shift attenuation method 73–8
^{30}Si in s–d shell, lifetimes 73–8

energy levels
BCS states projection method with respect to particle number 8–20
even–even nuclei, rotational energy levels of ground state bound in Krutov model 524–32
gap calculations using realistic and delta-function forces 274–9
^{79,81}Br, intermediate coupling model for low-lying levels 390–9
Ni quasi-particle structure of ground state of pairing Hamiltonian 520–3
^{206}Pb quasi-particle structure of ground state of pairing Hamiltonian 520–3

Octet theory, *see Field theory, quantum*
Onsager relations, *see Statistical mechanics; Thermodynamics*
Optical model, *see Nucleus*
Optical properties of substances
extinction theorem and $\epsilon_t(\boldsymbol{k}, \omega)$ 708–25
transverse response, and $\epsilon_t(\boldsymbol{k},\omega)$ 726–50
virtual mode theory and phenomenological binding energies in complex dielectric constant approximation 751–73
Optical quantum generators, *see Lasers*
Optics
many-body, screening of photon propagator L24–9
Oscillations, plasma, *see Plasma*

P–V–T relations, *see Equations of state*
Paraelectric materials, *see Dielectric properties of substances*
Permittivity, *see Dielectric properties of substances*
Perturbation theory, *see Field theory, quantum; Quantum theory*
Photoelectric effect, atomic, *see Atoms*
Photons
counting, correction methods for photon pile-up in lifetime determination 101–9
counting distributions over range of sample times and pumping levels relative to laser noise L52–5
counting fluctuations, digital autocorrelation; statistical accuracy L55–9
counting fluctuation autocorrelation function rel. to optical spectroscopy theory 201–15
statistics of Gaussian light scatt. by Gaussian medium L37–8
Pinch effect, *see Electric discharges; Plasma/confinement*
Pions
$\pi^+ n \rightarrow \omega p$ high-energy behaviour, Lorentz pole analysis 166–9
Plasma, *see also Electric discharges; Electrons; Ions*
afterglow, drift-dissipative instability, experimental observation L21–4
bernstein waves of negative energy giving rise to instability L40–4
ion motion and boundary as closed Mach surface 304–8
ionizing current sheet propagating into cold unionized gas, steady-state structure 421–6
wave propagation along magnetic field in two-component warm plasma 404–12
confinement
sheath at electrode close to plasma potential 413–20
sheath boundary, a Mach surface L39–40
electromagnetic waves
generation of vlf waves as a result of nonlinear mixing of 2 microwaves 547–58
magnetoplasma, electron density dependence on electron temperature 92–100
Plasma in solids, *see Electrons*
Plasma sheath, *see Plasma/confinement*
Plasmoids, *see Plasma*
Poiseuille flow, *see Flow; Hydrodynamics*
Polymers
self-avoiding random walk on lattice, equations derived 28–32
Programming, *see Digital computer programs*
Propagators, *see Field theory, quantum; Quantum electrodynamics*
Pulsars, *see also Cosmic rays*
as origin of superheavy nuclei in primary cosmic rays L33–6

Quantization, *see Field theory, quantum; Quantum theory*
Quantum counters, *see Photons*
Quantum electrodynamics, *see also Electrodynamics; Electromagnetism*
dielectric constant of pure liquid expressions derived using QED 595–607
force and couple exerted on moving electromagnetic dipole 251–62

Quantum electronics, *see Lasers; Photons*
Quantum field theory, *see Field theory, quantum*
Quantum fluids
fermion systems, ring intervals and Fermi function 342–5
Quantum mechanics, *see Quantum theory*
Quantum theory, *see also Field theory, quantum*
angular momentum J^2 eigenstate energies projected from Hartree–Fock state L2–4
laser with inhomogeneous broadening 189–200
Lippmann–Schwinger Kernel eigenvalues evaluation, sequences of functionals for L1–2
perturbation theory, time dependent 618–24
scattering lengths for static potentials, upper and lower bounds 1–7
many-particle systems, *see Quantum fluids; Statistical mechanics/quantum*

Radiation, *see also Čerenkov radiation*
damping formula re-derived using Wheeler–Feynman formalism 473–80
Radiosources, *see Cosmic rays*
Random processes, *see Fluctuations*
Rayleigh scattering, *see Light/scattering*
Red shift, *see Cosmology; Relativity*
Refraction of electromagnetic waves, *see also Electromagnetism*
liquids, pure, relative to dielectric constant calculations 595–607
Relativity, *see also Cosmology; Gravitation*
alternative field equations proposed by Kilmister, static spherically symmetric solutions 149–65
charged-dust distributions, theorems and relations 263–8
Einstein–Maxwell equations, class of solutions corresponding to stationary null electromagnetic fields 501–4
metric of moving bodies satisfying linearized Einstein field equations 493–500
neutrino field, two-component 136–48
tetrad equations for two-component neutrino field 269–73
time measurement using realizable clock in moving frame of reference 368–77
Reynolds number, *see Flow; Hydrodynamics*

S-matrix theory
Yang–Mills field, off-shell matrix, non-renormalizability 625–9
SU(3) group theory, *see Field theory, quantum; Group theory*
Scattering, hyperon, *see Hyperons*
Scattering, nuclear, *see Nuclear reactions and scattering*
Scattering, particles, *see Field theory, quantum; Nuclear forces; Nuclear reactions and scattering; S-matrix theory and under individual particles*
Scattering of light, *see Light/scattering*
Schrödinger equation, *see Quantum theory*
Schwarzschild space, *see Cosmology; Gravitation; Relativity*
Shell model, *see Nucleus*
Shock waves, plasma, *see Plasma*
Showers, cosmic ray, *see Cosmic rays*
Sparks, electric, *see Electric discharges*
Spectra, *see also Light, scattering*
line shape analysis using non-classical information theory 335–41
Spectral line breadth
information theory, non-classical, for shape analysis 335–41
Spectroscopy, *see also Spectra*
deconvolution with experimental error 462–72
optical, theory, by digital autocorrelation of photon-counting fluctuations 201–15
Spin, *see Hyperons; Mesons; Nucleus*
Spinors, *see Quantum theory*
Spions (pions with spin), *see Pions*
Statistical mechanics, *see also Lattice theory and statistics; Quantum fluids*
Boltzmann's H function, sign of successive time dervatives 331–4
classical Hamiltonian systems, dynamic irreversibility 128–35
correlation functions for classical systems in van der Waals limit L11–6
ergodicity and Lorentz transformation of time-based probabilities 113–20
relativistic, maximum entropy arguments 121–7
quantum
BCS states projection method with respect to particle number 8–20
Fermi function, ring integrals 342–5
master equation expansion, application to coupled atom-radiation systems 346–56
Steady-state theory, *see Cosmology*
Stimulated emission, *see Lasers*

Stokes flow, *see Flow; Hydrodynamics*
Streamers, *see Electric discharges*
Striations, *see Electric discharges*
Stripping reactions, *see Nuclear reactions and scattering*

Theory, nuclear, *see Nucleus*
Thermal conductivity
  column method for hydrogen, deuterium nitrogen 100–1100 °C 309–20
  He–HD mixture, conductivity/composition curve, evidence of minimum L29–31
Thermal diffusion columns, *see Thermal diffusion in gases*
Thermal diffusion in gases
  elementary theory based on assumption of velocity-dependent collision frequency 774–82
Thermodynamics, *see also Equations of state; Statistical mechanics*
  correlation functions for classical systems in van der Waals limit L11–6
Theta pinch, *see Plasma/confinement*
Time measurement
  in moving frame of reference using realizable atomic clock 368–77
Transmission of electromagnetic waves, *see Electromagnetism*
Transport processes, *see also Statistical mechanics*
  Boltzmann's *H* function, sign of succesive time derivatives 331–4
  master equation expansion, application to coupled atom–radiation systems 346–56
Turbulence, *see also Flow*
  hydromagnetic, isotropic, in incompressible fluid, correlation functions of velocity and magnetic field L50–2
  shear flow, direct interaction equations, simplification of L16–8
Turbulent flow, *see Flow*

Unified field theory, *see Relativity*

V-particles, *see Hyperons; Mesons*
Vacuum polarization, *see Quantum electrodynamics*
Vavilov-Čerenkov radiation, *see Čerenkov radiation*
Vectons (vector mesons), *see Mesons*
Vlasov equation, *see Plasma*

WKB method, *see Quantum theory*
Water
  turbulent flow spatial velocity distribution by intensity-fluctuation spectroscopy 216–28
Wave equations, quantum theory, *see Quantum theory*
Wave functions and wave mechanics, *see Quantum theory*

Author index with titles

Abou El Magd A. Mohamed and Nayyar N.K: electrohydrodynamic stability of liquid jet 296

Adcock C, Coats R.B, Wolfendale A.W. and Wdowczyk J: mean transverse momentum of secondaries from cosmic-ray interactions in region of 2×10^5 GeV 697

Agarwal B.K. with Saxena A.B. and Singh C.P: K* (892) production in rescattering model 280

Agarwal B.K. with Seth V.P. and Sharma M.C: unitary symmetry and superconvergence relations 170

Agarwal B.K. with Sharma M.C. and Seth V.P: superconvergence sum rules for backward meson–baryon scatterings 175

Alcock M.W. and Keen B.E: experimental observation of drift-dissipative instability in afterglow plasmas L21

Allen J.E. with Stangeby P.C: plasma boundary as Mach surface 304

Anderson N, Arthurs A.M. and Robinson P.D: complementary bounds on phase shifts 587

Anderson N, Arthurs A.M. and Robinson P.D: upper and lower bounds on scattering lengths 1

Andrews J.G. and Stangeby P.C: generalization of sheath criterion in anisotropic plasma L39

Andrews J.G. and Varey R.H: sheath at electrode close to plasma potential 413

Arthurs A.M. with Anderson N. and Robinson P.D: complementary bounds on phase shifts 587

Arthurs A.M. with Anderson N. and Robinson P.D: upper and lower bounds on scattering lengths 1

Bakich A. M, McCusker C.B.A. and Winn M.M: high transverse momenta observed in air shower cores 662

Bandyopadhyay P. and Ray Chaudhuri P: remarks on possible origin of super-heavy nuclei in primary cosmic rays L33

Bannerjee A: null electromagnetic fields in general relativity 501

Barnes A: gravitational collapse against cosmological background 653

Beiersdorf R. with Thielheim K.O: Monte Carlo studies on electromagnetic component of extensive air showers 79

Bell G.M. and Lavis D.A: two-dimensional bonded lattice fluids: I—interstitial model 427

Bell G.M. and Lavis D.A: two-dimensional bonded lattice fluids: II—orientable molecule model 568

Bergeson H.E. with Coats R.B, Ozaki S, Stenerson R.O, Keuffel J.W, Larson M.O, Lowe G.H, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689

Bertolotti M, Crosignani B. and Di Porto P: statistics of Gaussian light scattered by Gaussian medium L37

Bhatnagar T.N. and Sharma S.R: propagation of waves along magnetic field in two-component warm plasma 404

Bose S. with Varshni Y.P: Krutov model for deformed even–even nuclei 524

Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216

Bullough R.K: many-body optics: III—optical extinction theorem and $\epsilon_l(\boldsymbol{k}, \omega)$ 708

Bullough R.K: many-body optics: IV—total transverse response and $\epsilon_t(\boldsymbol{k}, \omega)$ 726

Bullough R.K: many-body optics: V—virtual-mode theory, and phenomenological binding energies in complex-dielectric-constant approximation 751

Butterworth J. with Bourke P.J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216

Carazza B. with Powles J.G: 'non-classical' information theory of spectral line shape 335

Castel B. with Stewart K.W.C: intermediate coupling model for Br isotopes 390

Cauwenbergh H. with Van Dael W: experimental evidence of minimum in thermal conductivity against composition curve for He–HD mixture L29

Chanmugam G: equation of state of matter at ultra-high densities L19

Chaudhury M.L: non-local barrier and anisotropy of alpha emissions from oriented ^{237}Np nuclei 378

Coats R.B. with Adcock C, Wolfendale A.W. and Wdowczyk J: mean transverse momentum of secondaries from cosmic-ray interactions in region of 2×10^5 GeV 697
Coats R.B, Ozaki S, Stenerson R.O. Bergeson H.E, Keuffel J.W, Larson M.O, Lowe G.H, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689
Codreanu S: equations governing second-order correlation functions for velocity and magnetic field of isotropic hydromagnetic turbulence in incompressible fluid L50
Coulter J.R.M. with Jackson A.T: ionization–diffusion waves in helium positive column 559
Cowling T.G: approximate theories of thermal diffusion 774
Crosignani B. with Bertolotti M. and Di Porto P: statistics of Gaussian light scattered by Gaussian medium L37
Currie W.M, Earwaker L.G, Martin J. and Sen Gupta A.K: lifetimes in some even nuclei in s–d shell 73

Davis C.C. and King T.A: correction methods for photon pile-up in lifetime determination by single-photon counting 101
De U.K. with Raychaudhuri A.K: charged-dust distributions in general relativity 263
Di Porto P. with Bertolotti M. and Crosignani B: statistics of Gaussian light scattered by Gaussian medium L37
Dissado L.A: absorption and refraction of radiation by liquids: I—refraction by pure liquids 595
Dissado L.A: absorption and refraction of radiation by liquids: II—solvent effects on absorption intensity 608
Dowker J.S: geometry of chiral dynamics: I 33
Dowker J.S: geometry of chiral dynamics: II 45
Dowker J.S: non-local Yang–Mills theory 59
Dowker J.S: when is 'sum over classical paths' exact? 451
Drain L.E. with Bourke P.J, Butterworth J, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216

Earwaker L.G. with Currie W.M, Martin J. and Sen Gupta A.K: lifetimes in some even nuclei in s–d shell 73
Egelstaff P.A. with Bourke P.J, Butterworth J, Drain L.E, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Ellis J.R: force and couple exerted on moving electromagnetic dipole 251
El-Nadi M. and Sharaf M.A: Multi-nucleon transfer reactions 179

Fomenko V.N: projection in occupation-number space and canonical transformation 8
Fomenko V.N: structure of paired states 520

Gates D.J: correlation functions for classical systems in van der Waals limit L11
Goto K. with Williams D.E.G: chemical potential of electron gas 563
Griffiths J.B. and Newing R.A: tetrad equations for two-component neutrino field in general relativity 269
Griffiths J.B. and Newing R.A: two-component neutrino field in general relativity 136

Hughes A.J. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Hutchinson P. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Hynne F: screening of photon propagator in many-body optics L24

Jackson A.T. and Coulter J.R.M: ionization–diffusion waves in helium positive column 559
Jackson D.A. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jakeman E, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216

Jain M.C. and Waghmare Y.R: nuclear energy gap calculations using realistic and delta-function forces 274
Jakeman E: theory of optical spectroscopy by digital autocorrelation of photon-counting fluctuations 201
Jakeman E. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Moss B, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Jakeman E, Oliver C.J. and Pike E.R: effects of spatial coherence on intensity fluctuation distributions of Gaussian light L45
Jakeman E, Oliver C.J, Pike E.R, Lax M. and Zwanziger M: intensity fluctuation distribution of laser light L52
Jakeman E, Pike E.R. and Swain S: statistical accuracy in digital autocorrelation of photon counting fluctuations L55
Jayaram, Sunita and Tripathi V.K: mixing of two microwaves and emission of low-frequency waves from plasma slab 547
Johns K.A. with Landsberg P.T: ergodicity and Lorentz transformation of time-based probabilities 113
Johns K.A. and Landsberg P.T: maximum entropy arguments in relativistic statistical mechanics 121
Jones A.F. and Misell D.L: problem of error in deconvolution 462
Jones A.V. with Papadopoulos G.J: ring integrals and Fermi function 342

Kamat R.V: Wheeler–Feynman absorber theory of radiation 473
Keen B.E. with Alcock M.W: experimental observation of drift-dissipative instability in afterglow plasmas L21
Kellermann E.W. with Towers L: electromagnetic component of large air showers 284
Keuffel J.W. with Coats R.B, Ozaki S, Stenerson R.O, Bergeson H.E, Larson M.O, Lowe G.H, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689
Khan T.P: radiation of Hertzian oscillator moving with superluminal velocity through dielectric medium 246
King T.A. with Davis C.C: correction methods for photon pile-up in lifetime determination by single-photon counting 101

Lakshmana Rao A, Rama Rao J. and Parthasaradhi K: observed variation of nuclear temperature with bombarding energy in $^{55}Mn(\alpha, n)\ ^{58}Co$ reaction 70
Landsberg P.T. and Johns K.A: ergodicity and Lorentz transformation of time-based probabilities 113
Landsberg P.T. with Johns K.A: maximum entropy arguments in relativistic statistical mechanics 121
Larson M.O. with Coats R.B, Ozaki S, Stenerson R.O, Bergeson H.E, Keuffel J.W, Lowe G.H, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689
Lashmore-Davies C.N: possible mechanism for instability in perpendicular collisionless shock wave L40
Lavis D.A. with Bell G.M: two-dimensional bonded lattice fluids: I—interstitial model 427
Lavis D.A. with Bell G.M: two-dimensional bonded lattice fluids: II—orientable molecule model 568
Lax M. with Jakeman E, Oliver C.J, Pike E.R. and Zwanziger M: intensity fluctuation distribution of laser light L52
Leiter D: interaction theory and Lagrangian electrodynamics 89
Leslie D.C: simplification of direct interaction equations for turbulent shear flow L16
Lodhi M.A.K: independent-particle-model energy levels 533
Loudon R: propagation of electromagnetic energy through absorbing dielectric 233
Lowe G.H. with Coats R.B, Ozaki S, Stenerson R.O, Bergeson H.E, Keuffel J.W, Larson M.O, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689

Maass W: sign of successive time derivatives of Boltzmann's *H* function 331
McCusker C.B.A. with Bakich A. M. and Winn M.M: high transverse momenta observed in air shower cores 662

McDonald N: comments on properties of projected spectra L2
Martin J. with Currie W.M, Earwaker L.G. and Sen Gupta A.K: lifetimes in some even nuclei in s–d shell 73
Mathews P.M: covariant theory of quantized electromagnetic field with only physical photons 357
Misell D.L: plural electron scattering and inclusion of phase factors L9
Misell D.L. with Jones A.F: problem of error in deconvolution 462
Moss B. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, O'Shaughnessy J, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216

Nayyar N.K. with Abou El Magd A. Mohamed: electrohydrodynamic stability of liquid jet 296
Newing R.A. with Griffiths J.B: tetrad equations for two-component neutrino field in general relativity 269
Newing R.A. with Griffiths J.B: two-component neutrino field in general relativity 136

Oliver C.J. with Jakeman E. and Pike E.R: effects of spatial coherence on intensity fluctuation distributions of Gaussian light L45
Oliver C.J. with Jakeman E, Pike E.R, Lax M. and Zwanziger M: intensity fluctuation distribution of laser light L52
Omojola D.A.F: neutron-alpha scattering 630
Osborne J.L. with Coats R.B, Ozaki S, Stenerson R.O, Bergeson H.E, Keuffel J. W, Larson M.O, Lowe G.H. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689
O'Shaughnessy J. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A. Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, Pike E.R. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Ozaki S. with Coats R.B, Stenerson R.O, Bergeson H.E, Keuffel J.W, Larson M.O, Lowe G.H, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689

Papadopoulos G.J. and Jones A.V: ring integrals and Fermi function 342
Parker J.H. with Coats R.B, Ozaki S, Stenerson R.O, Bergeson H.E, Keuffel J.W, Larson M.O, Lowe G.H. and Osborne J.L: lateral distribution of muon pairs in underground cosmic-ray showers 689
Parthasaradhi K. with Lakshmana Rao A. and Rama Rao J: observed variation of nuclear temperature with bombarding energy in ^{55}Mn(α, n) ^{58}Co reaction 70
Pert G.J: model of ionizing current sheet 421
Perveen, Suraiya: renormalization problem of Yang–Mills theory with non-zero mass: the spectral approach 625
Phillips G.W. with Tupper B.O.J: Kilmister's alternative field equations in general relativity: static spherically symmetric solutions 149
Pike E.R. and Swain S: expansion of master equation with applications to coupled atom–radiation systems 346
Pike E.R. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J. and Schofield P: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Pike E.R. with Jakeman E. and Oliver C.J: effects of spatial coherence on intensity fluctuation distributions of Gaussian light L45
Pike E.R. with Jakeman E, Oliver C.J, Lax M. and Zwanziger M: intensity fluctuation distribution of laser light L52
Pike E.R. with Jakeman E. and Swain S: statistical accuracy in digital auto-correlation of photon counting fluctuations L55
Powles J.G. and Carazza B: 'non-classical' information theory of spectral line shape 335
Prasad R.Y. and Singh R.N: temporal and spatial covariation of high-latitude geophysical phenomena 400

Rama Rao J. with Lakshmana Rao A. and Parthasaradhi K: observed variation of nuclear temperature with bombarding energy in $^{55}Mn(\alpha, n)^{58}Co$ reaction 70
Rastall P: metric of moving bodies 493
Raychaudhuri A.K. and De U.K: charged-dust distributions in general relativity 263
Ray Chaudhuri P: neutrinos and arrow of time in cosmology L5
Ray Chaudhuri P. with Bandyopadhyay P: remarks on possible origin of super-heavy nuclei in primary cosmic rays L33
Riska D.O. and Stenholm S: effects of detuning on quantum theory of inhomogeneously broadened laser 536
Riska D.O. with Stenholm S: quantum theory of laser with inhomogeneous broadening 189
Robinson L.C. and Szekeres G: motion of charged particles in helically perturbed magnetic field 481
Robinson P.D. with Anderson N. and Arthurs A.M: complementary bounds on phase shifts 587
Robinson P.D. with Anderson N. and Arthurs A.M: upper and lower bounds on scattering lengths 1

Sawhney B.K: self and mutual interaction of electromagnetic waves in magneto-plasma considering dependence of electron density on electron temperature 92
Saxena A.B, Agarwal B.K. and Singh C.P: K*(892) production in rescattering model 280
Saxena S.C. and Saxena V.K: thermal conductivity data for hydrogen and deuterium in range 100–1100°C 309
Saxena V.K. with Saxena S.C: thermal conductivity data for hydrogen and deuterium in range 100–1100°C 309
Schofield P. with Bourke P.J, Butterworth J, Drain L.E, Egelstaff P.A, Hughes A.J, Hutchinson P, Jackson D.A, Jakeman E, Moss B, O'Shaughnessy J. and Pike E.R: study of spatial structure of turbulent flow by intensity-fluctuation spectroscopy 216
Sen Gupta A.K. with Currie W.M, Earwaker L.G. and Martin J: lifetimes in some even nuclei in s–d shell 73
Sen Gupta N.D: time-dependent perturbation theory 618
Seth V.P. with Sharma M.C. and Agarwal B.K: superconvergence sum rules for backward meson–baryon scatterings 175
Seth V.P. Sharma M.C. and Agarwal B.K: unitary symmetry and superconvergence relations 170
Sharaf M.A. with El-Nadi M: multi-nucleon transfer reactions 179
Sharma C.S: sequences of functionals for evaluation of eigenvalues of Lippmann-Schwinger kernel L1
Sharma M.C, Seth V.P. and Agarwal B.K: superconvergence sum rules for backward meson–baryon scatterings 175
Sharma M.C. with Seth V.P. and Agarwal B.K: unitary symmetry and super-convergence relations 170
Sharma S.R. with Bhatnagar T.N: propagation of waves along magnetic field in two-component warm plasma 404
Singh C.P. with Saxena A.B. and Agarwal B.K: K*(892) production in rescattering model 280
Singh R.N. with Prasad R.Y: temporal and spatial covariation of high-latitude geophysical phenomena 400
Srinvas Rao A: Lorentz pole analysis of reaction $\pi^+ n \to \omega p$ 166
Stangeby P.C. and Allen J.E: plasma boundary as Mach surface 304
Stangeby P.C. with Andrews J.G: generalization of sheath criterion in anisotropic plasma L39
Stenerson R.O. with Coats R.B, Ozaki S, Bergeson H.E, Keuffel J.W, Larson M.O, Lowe G.H, Osborne J.L. and Parker J.H: lateral distribution of muon pairs in underground cosmic-ray showers 689
Stenholm S. with Riska D.O: effects of detuning on quantum theory of inhomogeneously broadened laser 536
Stenholm S. with Riska D.O: quantum theory of laser with inhomogeneous broadening 189
Stephenson L.M: possible implications of 3K background radiation L49
Stephenson L.M: time measurement using realizable atomic clock in moving frame of reference 368
Stewart K.W.C. and Castel B: intermediate coupling model for Br isotopes 390
Swain S. with Jakeman E. and Pike E.R: statistical accuracy in digital auto-correlation of photon counting fluctuations L55

Swain S. with Pike E.R: expansion of master equation with applications to coupled atom–radiation systems 346
Szekeres G. with Robinson L.C: motion of charged particles in helically perturbed magnetic field 481

Thielheim K.O. and Beiersdorf R: Monte Carlo studies on electromagnetic component of extensive air showers 79
Towers L. with Kellermann E.W: Electromagnetic component of large air showers 284
Tripathi V.K. with Jayaram, Sunita: mixing of two microwaves and emission of low-frequency waves from plasma slab 547
Tupper B.O.J. and Phillips G.W: Kilmister's alternative field equations in general relativity: static spherically symmetric solutions 149

Valleau J.P. with Whittington S. G: figure eights on square lattice: enumeration and Monte Carlo estimation 21
Van Dael W. and Cauwenbergh H: Experimental evidence of minimum in thermal conductivity against composition curve for He–HD mixture L29
Varey R.H. with Andrews J.G: sheath at electrode close to plasma potential 413
Varshni Y.P. and Bose S: Krutov model for deformed even–even nuclei 524

Waghmare Y.R. with Jain M.C: nuclear energy gap calculations using realistic and delta-function forces 274
Wallace M.R: perturbation of relativistic bootstraps 505
Wdowczyk J. with Adcock C, Coats R.B. and Wolfendale A.W: mean transverse momentum of secondaries from cosmic-ray interactions in region of 2×10^8 GeV 697
Whittington S.G: excluded volume effect in polymers 28
Whittington S.G. and Valleau J.P: figure eights on square lattice: enumeration and Monte Carlo estimation 21
Williams D.E.G. and Goto K: chemical potential of electron gas 563
Winn M.M. with Bakich A.M. and McCusker C.B.A: high transverse momenta observed in air shower cores 662
Wolfendale A.W. with Adcock C, Coats R.B. and Wdowczyk J: mean transverse momentum of secondaries from cosmic-ray interactions in region of 2×10^8 GeV 697

Zwanziger M. with Jakeman E, Oliver C.J, Pike E.R. and Lax M: intensity fluctuation distribution of laser light L52

Book review index

Aleksandrov Y.A. *et al*: bubble chambers 111
Aly H.H. (Ed.): lectures in theoretical high energy physics 110
Arnold V.I. and Avez A: ergodic problems of classical mechanics 230

Baym G: lectures on quantum mechanics 322
Bhagavantam S. and Venkatarayudu T: theory of groups and its application to physical problems 785
Buchdahl H.A: an introduction to Hamiltonian optics 448
Bohr A. and Mottelson B.R: nuclear structure, vol. 1 322
Burhop E.H.S. (Ed.): high energy physics, vols. 3 and 4 583

Cence R.J: pion–nucleon scattering 448
Covington A.K. and Jones P. (Eds.): hydrogen-bonded solvent systems 111

De Groot S.R: the Maxwell equations 230

Fain V.M. and Khanin, Ya. I: quantum electronics, vol. 1 582
Fain V.M. and Khanin, Ya. I: quantum electronics, vol. 2 582
Feenberg E: the theory of quantum fluids 447
Flugge S. (chief Editor): encyclopaedia of physics: light and matter 785

Goldman L: biomedical aspects of the laser 112

Henderson C: cloud and bubble chambers 443
Höhler G. (Ed.): Springer tracts in modern physics, vols. 49 and 50 323
Höhler G. (Ed.): Springer tracts in modern physics, vol. 52, weak interactions 447

Jordan T.F: linear operators for quantum mechanics 232

Kalman G. and Feix M. (Eds.): nonlinear effects in plasmas 442
Kaula W.M: an introduction to planetary physics (space science text series) 111

Landau L.D. and Lifshitz E.M: statistical physics—course of theoretical physics, vol. 5 582
Liboff R.L: the theory of kinetic equations 326

McCarthy I.E: introduction to nuclear physics 110
Martin A: scattering theory: unitarity, analyticity and crossing 445
Müller C: foundations of the mathematical theory of electromagnetic waves 442

Paic G. and Slaus I. (Eds.): few body problems. Light nuclei and nuclear reactions, vols. 1 and 2 444
Petrov A.Z: Einstein spaces 229

Roman P: introduction to quantum field theory 325
Ross D: lasers, light amplifiers and oscillators 321
Rye B.J. and Taylor J.C. (Eds.): physics of hot plasmas 783
Rzewuski J: field theory, vol. 2 445

Shaw G.L. and Wong D.Y. (Eds.): pion–nucleon scattering 326
Simon A. and Thompson W.B: advances in plasma physics 784
Simon A. and Thompson W.B. (Eds.): advances in plasma physics, vol. 2 321
Swihart T.L: astrophysics and stellar astronomy 325

Talman J.D: special functions (a group theoretical approach) 446
Taylor J.G: quantum mechanics: an introduction 783
Taylor R.J, Davidson W, Narlikar J.V. and Ruderman M.A: astrophysics 229
Tye R.P. (Ed.): thermal conductivity, vol. 2 583

Unsöld A: (translated by McCrea W.H.): the new cosmos 324

Wolf E. (Ed.): progress in optics, vol. 7 231

Young L, Eds. Clarricoats P.J.B. and Lawrenson P.T.: systems of units in electricity and magnetism 449